

Memorandum

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From : California Energy Commission - Marc Pryor
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Project Manager

Subject : **POTRERO POWER PLANT UNIT 7 PROJECT (00-AFC-4) – 1) SUPPLEMENTAL
TSE TESTIMONY; 2) CALIF. ISO TESTIMONY**

In accordance with the Committee's Hearing Order of August 13, 2002, attached are 1) staff's Supplemental Transmission System Engineering (TSE) testimony that addresses Mirant's Switchyard Amendment of July 2002; and, 2) California Independent System Operator (ISO) testimony. The latter provides an explanation for why the ISO would consider the outage of the proposed Potrero Unit 7 to be a single contingency rather than a multiple contingency for purposes of planning and operating the grid.

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TRANSMISSION SYSTEM ENGINEERING - SUPPLEMENT

Testimony of Mark Hesters and Al McCuen

INTRODUCTION

In its Application for Certification for the Potrero Power Plant Unit 7 Project (Unit 7) the applicant, Mirant (then Southern Energy), proposed to connect the Unit 7 Project to a new Potrero Power Plant Switchyard and from there to both the Pacific Gas & Electric Company's (PG&E) Potrero and Hunters Point Substations. Then, in its May 29, 2002, testimony, Mirant changed the interconnection proposal by eliminating the switchyard and connecting Unit 7 directly to PG&E's Potrero Substation. This filing also contained a Facilities Study for the new interconnection that identified alternative methods for mitigating emergency line overloads. The interconnection study identified several emergency overloads with line reconductoring or soil replacement as a mitigation option.

Staff issued data requests regarding these changes and Mirant provided responses on July 17, 2002 (URS, Switchyard Amendment). Mirant's responses described and clarified switchyard changes, the reasons for the changes, identified mitigation for emergency overloads, and provided a sensitivity study analyzing the effects of the Potrero Power Plant Unit 7 Project (Unit 7 Project) and the Hunters Point Power Plant on the transmission network.

FACILITY STUDY AND DOWNSTREAM TRANSMISSION FACILITIES

The Facility Study provided in Mirant's May 29, 2002, testimony only studied the new interconnection with the Hunters Point Power Plant not operating. Staff requested a sensitivity study analyzing the impacts of the Unit 7 Project with the new interconnection and the Hunters Point Power Plant operating. The sensitivity study identified several emergency overloads and one normal overload. The overloads are not extensive and Staff agrees with the study's conclusion that operating procedures could be used to mitigate the overloads until the Hunters Point Power Plant is shut down. Because Mirant committed to using Special Protection Systems to mitigate the identified emergency overloads, no additional downstream transmission facilities will be required.

CONCLUSION

Mirant has fully described the proposed interconnection of the Unit 7 Project to PG&E's transmission network. Mirant committed to using Special Protection Systems to mitigate emergency overloads identified in the Facilities Study. No downstream transmission facilities beyond those identified in the Final Staff Assessment require analysis in this process, and no changes to staff's proposed conditions of certification are required.

Power Plant Reliability: Potrero Power Plant Unit 7 Project

Testimony of Johan Galleberg

PURPOSE OF THIS TESTIMONY

The purpose of this testimony is to provide an explanation for why the California Independent System Operator ("ISO") considers the outage of the three electric generating units (two combustion turbine (CT) generators and one steam turbine (ST) generator, in a 2-on-1 configuration) that make up the proposed Potrero 7 combined cycle plant to be a single contingency rather than a multiple contingency for purposes of planning and operating the grid. The potential benefits of new generation on the San Francisco Peninsula and from Potrero 7 in particular have been described in detail in testimony previously filed with the California Energy Commission ("CEC") under the title "Local System Effects" and will not be discussed in this testimony.

SUMMARY

The ISO has determined that, as proposed, Potrero Unit 7 should be treated as a single contingency when it becomes operational. In making this determination, the ISO reviewed the actual operating experience to date with similar (but not identical) new combined cycle units currently in operation in California as well as the design of the proposed Potrero Unit 7 facility. The ISO's determination is based in large part on the performance history of new combined cycle units similar in design to Potrero Unit 7 and our experience to date with these units. The number of new combined cycle facility forced outages that have taken place does not support a double contingency categorization for new combined cycle units in general. Moreover, there is nothing in the design of Potrero Unit 7 that persuades the ISO that the number of facility forced outages at Potrero Unit 7 can be expected to be substantially different from that of comparable new combined cycle units. It should be noted that all of the combined cycle units that are online today are treated as single contingencies. The ISO's conclusion as to Potrero 7 is further bolstered by the fact that the facility is to be located in an area that has significant reliability concerns. Thus, a mistake in the categorization of Potrero 7 could result in the controlled loss of load in the area. Finally, it is possible that the categorization of Potrero 7 and other combined cycle facilities could be revised if future operating experience provides the basis for a change. Until this is the case, however, the

single contingency categorization is justified; although, given the importance of the issue, the ISO will continue to track the performance of new combined cycle plants

INTRODUCTION

A primary role of the ISO is to ensure the reliable operation of the ISO Controlled Grid. The interconnection of a new generator if not properly designed and operated, could adversely impact the reliable operation of the power system. Potrero Unit 7 represents a significant new source of generation to serve load in the immediate San Francisco Peninsula Area and would substantially reduce the need to import power across the transmission lines further south on the Peninsula. Thus, the ISO views this plant as a new source of much needed generation in an area that is dominated today by old and unreliable generation.

ISO GRID PLANNING STANDARDS

The ISO Grid Planning Standards apply to all existing and proposed facilities interconnecting to the ISO Controlled Grid. The NERC/WECC Planning Standards (part of the ISO Grid Planning Standards) dictate the maximum allowable impacts on the grid resulting from various types of contingencies or “disturbances”. These contingencies are classified into different categories, based upon severity and expected occurrence. For instance, the probability of a single contingency (loss of a single element) is greater than the probability of a double contingency (loss of two elements) and must therefore meet a stricter performance standard. While no emergency overloads should occur after either a double or a single contingency, controlled loss of load is allowed after some double¹ contingencies. The ISO Grid Planning Standards also include other performance standards that must be met in order to maintain system stability and adequate voltage margin in the system.

The San Francisco Greater Bay Area Generation Outage Standard² (also part of the ISO Grid Planning Standards) dictates that the single largest generation unit and one 50 MW CT on the San Francisco Peninsula in addition to one 50 MW CT in the Greater Bay Area (outside the Peninsula) should be taken out of service in the “base case” (NERC Category A) when performing planning studies for the San Francisco Greater Bay Area. Today, the single largest unit on the Peninsula is Potrero 3 (207 MW). After Potrero 7 comes online, if it were classified as a single

¹ A combined line and generator outage shall meet the performance requirements of the NERC Planning Standards for Category B (single) contingencies. According to the ISO Grid Planning Standards, controlled loss of load can be implemented for all other types of double contingencies, for instance the simultaneous loss of two generators.

² The reason for having special generation criteria for the San Francisco area is due to the fact that the existing generation in San Francisco is highly vulnerable. For instance, both Hunters Point Unit 4 (163 MW) and Potrero Unit 3 (207 MW) are significantly beyond their expected 30 year lifetime and exhibit frequent outages.

contingency, the single largest unit would become Potrero 7 (540 MW), a net increase in load serving capability of 207 MW if all other generation remain the same. If Potrero 7 were classified as a double contingency, the single largest contingency on the Peninsula would be 270 MW (One CT and half of the steam turbine from Potrero 7). The net increase in load serving capability would therefore be 477 MW.

PROBABILISTIC BASED RELIABILITY CRITERIA

The table below is taken from WECC's Reliability Performance Evaluation Work Group's report called Phase I Probabilistic Based Reliability Criteria. This document was approved by the WECC Planning Coordination Committee (PCC) and Board of Trustees (BOT) in the summer of 2001. The purpose of this probabilistic based reliability criteria is to provide a means to reclassify a facility to meet a standard other than the classification dictated by the NERC/WECC Planning Standards. If a facility has excessive outages for its current classification, then it should be reclassified and expected to meet the requirements of a more stringent performance category. If a facility can be shown to perform much better as compared to its current classification, the facility operator may request that the facility be qualified to meet the requirements of a less stringent performance category. Note that only the outage frequency is evaluated and not the outage time.

The same principle could also be applied to generating facilities. This means that a combined cycle facility that meets performance level A in the table below will be treated as a single element outage (NERC/WECC Category B outage) and a combined cycle facility that meets performance level B or C in the table below will be treated as a multiple element outage (NERC/WECC Category C outage).

Performance Level	Disturbance Outage Class	Outage Frequency (outages/year)	Mean-Time-Between-Failure (year)	Comment
A	Single Element	0.33	3	
B	Bus Section	0.033 – 0.33	3 - 30	
C	Two Element	0.033 – 0.33	3 - 30	
D	More than Two Elements	0.0033 – 0.033	30 - 300	No cascading permitted

Table 1: Phase I PBRC Performance Table

This approach can be used in determining whether the entire loss of Potrero 7 should be considered to be a level B (single) or C (double) contingency. For the plant to be considered a double contingency, the mean time between failure should be between 3 and 30 years (a failure here means a forced outage that brings the

generation plant to zero MW during a time period from a few seconds up to 30 minutes). Irrespective of the risk of a catastrophic failure on each critical component of the plant (i.e. condenser failure or control system failure), the combined failure rate of the entire plant is what should determine how the plant should be classified.

ACTUAL PERFORMANCE OF NEW COMBINED CYCLE FACILITIES IN THE ISO CONTROL AREA.

The ISO has real time telemetry from most of the generation units that participate in the ISO markets, including the combined cycle units that have come on-line in California during the last two years. All data (including for instance MW and Mvar output of each unit) is stored in a database. In addition, the Outage Coordination Department at the ISO keeps track of all planned and unplanned generation outages for each generation unit, along with the cause of the outage.

In reviewing the appropriate categorization for Potrero 7, the ISO reviewed the forced outage history for three new combined cycle facilities in California, Los Medanos Energy Center (Los Medanos), Delta Energy Center (Delta), and Sutter Energy Center (Sutter)³. Los Medanos and Sutter have been in service since the summer of 2001, Delta has only been operational since early summer 2002.

Table 2 below sets forth the facility forced outages for each of these facilities since they went into operation, i.e. forced outages that resulted in an output of zero MWs.⁴ The table demonstrates that facility forced outages have significantly exceeded once every 3 to 30 years. Moreover, the ISO considers that the level of facility forced outages is significantly above the once every 3 to 30 years even accounting for the fact that new combined cycle facilities tend to be less reliable during start-up periods and during the initial weeks of operation. For example, four of the forced outages that caused all the three units at Los Medanos to go off-line took place more than nine months after the facility went into operation.

³ Los Medanos and Sutter have two combustion turbines (CT's) and one steam turbine (ST) each in a 2x1 configuration. Delta has three combustion turbines (CT's) and one steam turbine (ST) in a 3x1 configuration. All three are owned by the Calpine Corporation.

⁴ Only forced outages due to failure at the power plant itself are reported, forced outages due to failure on the transmission system/switchyard are excluded. The fact that a facility experienced a forced outage on a particular day is public information. In fact, information on unavailable generating units has been posted daily on the ISO website since January 1, 2001. However, the ISO treats information regarding the cause of an outage as confidential information.

Facility	Date	# units lost
Sutter ⁵	08/17/01	No visibility
Sutter	10/08/01	1 CT
Sutter	12/29/01	All 3
Sutter	04/15/02	1 CT + ST
Sutter	05/28/02	1 CT
Sutter	09/06/02	All 3
Los Medanos ⁶	10/04/01	All 3
Los Medanos	06/05/02	All 3
Los Medanos	06/17/02	All 3
Los Medanos	06/23/02	1CT+ST
Los Medanos	07/19/02	All 3
Los Medanos	07/23/02	1CT+ST
Los Medanos	09/12/02	All 3
Delta ⁷	06/23/02	All 4
Delta	06/29/02	2 CT's + ST
Delta	08/07/02	2 CT's + ST

Table 2: Forced outages that have resulted in 0 MW output from Sutter, Los Medanos and Delta since they became operational

The ISO focused on outage data from new combined cycle units in California because there is little historic data available to describe the performance of the newer combined cycle units. The ISO realizes that this data is very limited, nevertheless, it shows that these three plant's current classification as single contingencies are justified.

POTRERO 7 PLANT DESIGN VERSUS THE PLANT DESIGN OF OTHER NEW COMBINED CYCLE PLANTS

Chapter 2.4 "Facility Reliability" in the Application for Certification, Potrero Power Plant Unit 7 Project, outlines the expected plant availability and equipment redundancy that are incorporated into the current design of Potrero 7. The ISO recognizes the emphasis on operational reliability in the design of Potrero 7; some of the reliability features included in the design are as follows:

- 100 % steam bypass capability, allows for continued operation after loss of the steam turbine.
- Redundancy in number of boiler feedwater pumps, cooling water pumps etc.
- Redundant microprocessor based Distributed Control System (DCS)
- Split condenser (two waterboxes)⁸

⁵ Data for Sutter is recorded from 07/03/01 to 08/10/02

⁶ Data for Los Medanos is recorded from 08/23/01 to 08/10/02

⁷ Data for Delta is recorded from 06/17/02 to 08/10/02

In addition, the proposed configuration of the switchyard and outlet lines from the substation is such that no outage of any single element can cause the entire plant to trip.

Since combined cycle generation plants are large, complex systems, no two plants are identical. Nonetheless, many of the combined cycle plants recently approved or currently under review by the CEC have a similar design to Potrero 7, with some exceptions. Potrero 7's 2-on-1 design utilizing the GE 7FA Frame is common. Los Medanos for instance has this design. The differences in major equipment redundancy (i.e. number of condensate pumps, circulating water pumps, compressors, boiler feed pumps and DCS) are fairly small. 100 % steam bypass has been incorporated into the design of Potrero 7 and is expected to increase the reliability of the plant since this will allow the plant to continue operation after loss of the steam turbine. However, this design is not unique to Potrero 7, several other plants both in operation today and many more in the licensing and construction phases have this capability incorporated. Sutter and Los Medanos have also 100 % steam bypass incorporated. The split condenser design of Potrero 7 will allow repair and tube cleaning to take place while the unit is online. This significantly increases the reliability of the condenser which again should increase the reliability of the plant. However, forced outages due to condenser failures represent a fairly small number of the total forced outages experienced by the new combined cycle units in California. For instance, none of the reported forced outages from either Sutter or Los Medanos in Table 2 are directly related to the condenser. Thus, the change in the condenser design would not eliminate the types of forced outages experienced to date by new combined cycle facilities in California.

CONCLUSIONS

- Actual performance data for three similar (but not identical) facilities in California indicates that Potrero 7 should be classified as a single contingency.
- The reliability features in the design of Potrero 7 do not support a conclusion that Potrero 7 will be significantly more reliable than the other comparable new plants currently in service.
- A reliable track record needs to be established for Potrero 7 before it can be potentially considered as a double contingency.
- The risk for controlled loss of load is significant if Potrero 7 is classified as a double contingency.

⁸ The plant has a single condenser and a catastrophic failure of the condenser will cause the plant to shut down. However, the likelihood of such a failure is assumed to be fairly small, since one-half of the condenser can be removed from service for cleaning, plugging tubes and other maintenance during normal operation at reduced load.

DECLARATION OF JOHAN GALLEBERG:

I, Johan Galleberg declare as follows:

1. I am a Grid Planning Engineer presently employed by the California Independent System Operator (California ISO).
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I prepared the California ISO testimony on power plant reliability for the Potrero Power Plant Unit 7 Project based upon my independent analysis of the Application for Certification, data from reliable documents and sources, and my professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: October 10, 2002

Signed: _____